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Scallop stock update for SPA 6, Grand Manan and Southwest New Brunswick - 1998

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Abstract

An area based management plan was implemented in 1997 for the scallop fishery in the Bay of Fundy. Scallop Production Area (SPA) 6 refers to the waters surrounding Grand Manan Island, Campobello and Deer Islands and vicinity. This area is subdivided into SPA 6A for the area outside the inside zone and SPA 6B for the Grand Manan Island inside zone. This area is fished by the Mid Bay scallop fleet using competitive quota system and Full Bay scallop fleet which is under an Individual Transferable Quota (ITQ) system.

The landings in 1998 increased from 1997. The first quarter landings comprised 71% of total landings for the year. Numbers of Mid Bay vessels fishing SPA 6 remained constant while there was a decrease in the number of Full Bay vessels fishing this SPA from 1997. Catch rates increased for both fleets. Port sampling indicated a decrease in numbers of larger scallops landed as the year progressed. The 1999 survey indices indicated a decrease in average number per tow of commercial sized scallops in the inside zone, SPA 6B. This could be attributed to concentrated fishing effort in January to March of 1998. There was an increase in pre-recruits in both areas. The survey mean weights were average. A cautious approach in harvesting strategies should be taken to ensure stock depletion does not become an issue.

Résumé

En 1997, un plan de gestion par zone de pêche a été mis en œuvre dans la baie de Fundy. La zone de production du pétoncle (ZPP) 6 désigne l'étendue d'eau entourant les îles Grand Manan, Campobello, Deer, ainsi que le secteur avoisinant. Elle est formée de deux sous-zones: ZPP 6A, qui s'étend à l'extérieur de la zone interne, et ZPP 6B, correspondant à la zone interne de l'île Grand Manan. Cette zone est exploitée par la flottille de Mid Bay qui utilise un système compétitif de quota, et par celle de Full Bay, suivant un système de quota individuel transférable (QIT).

Il y a eu une hausse des débarquements en 1998, ceux du premier trimestre représentant 71 % du total de l'année. Le nombre de bateaux employés pour la pêche par Mid Bay dans la ZPP 6 est demeuré constant, tandis que le nombre utilisé par Full Bay dans cette zone a diminué par rapport à 1997. Les taux de capture des deux flottilles ont augmenté. D'après l'échantillonnage au port, le nombre de pétoncles de grandes tailles a diminué au fil de la saison. Un relevé en 1999 a également permis de constater une baisse du nombre par trait de pétoncles de taille commerciale dans la zone interne, ZPP 6B, qui pourrait être attribuable à la concentration de l'effort de pêche de janvier à mars 1998. On a noté une augmentation de pré-recrues dans les deux zones. Les poids moyens, obtenus lors des relevés, ont été de valeur moyenne. Afin d'éviter les problèmes liés au dépérissement des stocks, il faudra appuyer les stratégies de récolte selon une approche prudente.

Introduction

Commercial Scallop fishing in the Bay of Fundy was reported as early as 1889. W.F. Ganong reported a small annual fishery of about 200 bushels coming from Mace's Bay and L'Etang and sold in Saint John. The area off the Charlotte county coast of southwest New Brunswick was the only regular scallop fishery until the discovery of scallop beds in Annapolis Basin in 1920. The Digby fishery quickly included the rest of the Bay of Fundy. Lescarbot reported the presence of scallop in the Annapolis Basin as early as 1609. Scallop fishing regulations such as licenses, closed seasons and minimum size were implemented as early as 1918. In 1939 a gear size restriction was introduced for the Grand Manan area (Robert et al. 1984).

In 1987 a series of conservation initiatives were implemented for the Bay of Fundy and its approaches. Meat counts and minimum shell height limits and scallop gear regulations were introduced. This limited gear width to 5.5 m with ring size of less than 82 mm inside diameter. Offshore rakes and sweep drags were not permitted (Robert et al 1987). The Grand Manan area has two inside zones. A 2-mile inside zone surrounds Grand Manan Island and a 2-mile line extends along the New Brunswick coast from Deer Island to Cape Spencer. Fishing is limited in these inside zones from the second Tuesday in January to March 31. The area outside these zones is open January 1 to December 31(Robinson et al 1992). In 1987, the exploitable grounds were extended for license holders on the southwest side of New Brunswick from 7 miles from the New Brunswick shore to the middle of the Bay of Fundy or Mid Bay Line. The license name was changed from 7 mile NB to Mid Bay. The Mid Bay fleet is comprised mainly of vessels <14.5 m length overall (LOA) and carry multiple species licenses. The Full Bay fleet consists mainly of vessels > 14.5 m LOA or 25.5 GT (gross tons) and this license permits fishing anywhere in the Bay of Fundy.

An area based management plan was implemented in 1997 for the Bay of Fundy. Using the biology of the scallop and distribution of the scallop beds, the bay was divided into 7 management areas referred to as Scallop Production Areas (SPA) (Figure 1). SPA 6 refers to Grand Manan and surrounding area which is further divided into SPA 6A for the area outside the inside zone and SPA 6B for the Grand Manan Island inside zone. The boundaries of the new SPA 6B inside zone differ from pre 1997 Grand Manan Island inside zone. The New Brunswick mainland inside zone was included in SPA 6A when the SPA boundaries were determined. Meat count, minimum shell height, minimum meat weight and seasonal closures are used for management of the production areas for both fleets. In addition the Full Bay Fleet is managed by quota and Individual Transferable Quota (ITQ) while the Mid Bay fleet have maintained a competitive quota fishery (effort cap or quota). Fishery data consisting of landings, license information and preliminary catch rates, port sampling from an industry sponsored port sampling program and survey information is used to assess the stock status.

Methods

Fishery Data

All vessels >25.5 GT or 14.5 m, licensed to fish scallops in the Bay of Fundy, are required to complete daily logbooks. Prior to 1996 the number of vessels from either Mid Bay or Full Bay fleets completing logbooks has varied greatly. A Dockside Monitoring Program was initiated in 1996. This required the completion and submission of a Dockside Monitoring Document (DMD) giving information such as date, location, depth, and effort on that fishing trip and catch landed. A dockside monitored trip requires a certified monitor to oversee the weigh out of the catch. The information was electronically entered into a database and the database sent to the Commercial Data Division, DFO. Compliance for the Mid Bay fleet was voluntary in 1996 but license conditions in 1997 made it mandatory. Compliance for Mid Bay fleet included hail in and hail out, completing the monitoring document and submitting it to the monitoring company within 48 hours of landing. The Full Bay fleet are required have 100% of the landings monitored at dockside since 1996.

Landings complied by Statistical Districts from sales slips and logbooks and since 1997 using the Dockside Monitoring Documents are obtained from Commercial Data Division, DFO. For historical comparison, statistical districts 49 through to 53 most closely approximate catches from SPA 6. These landings indicate where the scallops were landed but not where the scallops were fished. Landings are available by Statistical District for 1998 (Table 1). As quotas were identified by SPA, landings in 1997 and 1998 were also compiled by Scallop Production Area using fishing location on the Dockside Monitoring Documents (Table 2).

The information (date, location, number of tows per day, length of tows, crew, depth, bottom type and catch) on the DMDs is used to calculate catch rates and map fishing locations. Catch rates and fishing locations prior to 1996 are not indicative of the fishery for the Mid Bay fleet. Class 1 data is complete log information which includes effort, catch and location. Class 1 data is used to calculate catch rates

Port Sampling

Port samples have been collected from the Full Bay fleet for several years however there are insufficient numbers of samples from the Grand Manan fishing grounds to be representative of the catch composition of the fishery in that area. The sampling was concentrated primarily on Full Bay vessels landing in ports on the Nova Scotia side of the Bay. This program has been funded by DFO Science.

Port samples are not available from the Mid Bay fleet for the Grand Manan area and the the southwest New Brunswick side of the Bay of Fundy prior to 1998. In January 1998, the Grand Manan Fisherman's Association initiated an industry sponsored port sampling

program for the Grand Manan Island fishing area. This information provided DFO with catch composition information and with the co-operation with the fishers was used to monitor the percentage of small scallop meats (<11g) in the catch in an effort to conserve the smaller scallops for future increase in yield. The Campobello Fisherman's Association joined the port sampling program in April 1998 and has also supplied samples to DFO. A port sample consists of 2-500 g samples of scallops collected from the landed catch of a vessel. The date, boat, depth and location the scallops were fished are recorded. The catch muscle is removed and the scallops from each sample are weighed individually and the weight is recorded on the data sheet. The sample information and the meat weights are put in a spreadsheet and electronically transferred to DFO Science for analysis. The mean, standard deviation, minimum and maximum meat weight, total weight and a meat count per 500g and percentage of 11g meats in the samples were calculated by month (Table 5 and 6).

Research Survey

Annual stock assessment surveys of the Grand Manan area were conducted from 1979 to 1991. The annual stock assessment survey resumed in 1996. A total of 65 stations were randomly selected based on historical fishing information. The 1997 survey repeated the stations from 1996 with several additional stations based on current fishing location information for a total of 90 stations. Only 65 stations were completed due to mechanical problems with the survey vessel. The 1998 survey used the original 1996 stations, the additional stations from 1997 plus several others chosen as in the previous year to sample areas not included in the previous two surveys for a total of 93 stations. All stations were completed in 1998.

Recent research surveys have been conducted in September on the research vessel J.L. Hart using 4-gang Digby style scallop gear. This gear consists of 4 drags with inside width of 76 cm made of 4 mm steel rings with an inside diameter of 75 mm linked together with rubber washers and attached to an angle iron frame at the mouth and a steel plate or section of wood at the bottom. The drag is 7 rows of rings, 9 across and 3 on the side (Kenchington et all, 1997). As smaller scallops can avoid the drags or escape through the steel rings (Robert and Lundy, 1989), two of the drags are lined with 38mm polypropylene mesh shrimp netting. The abundance estimates of scallops less than 80 mm shell height are based on the lined drags. The abundance estimates of scallops 80 mm or greater shell height are based on the unlined drags. The catches were prorated to 7 gang gear for comparison with previous survey information.

Tows were 8 minutes in duration. The distance towed was determined from the continuous reading of latitude and longitude with GPS (Global Positioning System) receiver via computer or on occasion from the start and end latitude and longitude of the tow. The tows were standardized to a length of 800 m or dragged area of 4256 square meters. For each tow the following information was recorded: numbers of scallops by shell height in 5 mm intervals for live and dead scallops (shells with both valves still attached at the hinge) by drag; type of substrate; direction of tow (compass bearing);

depth (m); tow location (latitude and longitude); length of tow; and individual scallop shells and meats from each tow were labeled and retained for further analysis.

Results

Fishery Data

Landings from Statistical Districts 49 to 53 (SPA 6) comprise less than 25% of the total landed in the Bay of Fundy. There was a 15% increase in 1998 landings as compared with landings from 1997 (Table 1). Generally landings have been decreasing since 1993 (Figure 2)

71% of the landings took place during the first quarter of 1998 (Figure 3). This was an increase from 1997 when 53% of the landings were reported from the first quarter. The increase can be attributed to the seasonal fishery conducted in SPA 6B or the Grand Manan inside zone. The 1997 survey had indicated an increase in the commercial sized scallops 85 to 105 mm shell height in the inside zone. In April when the fishery moved to the outside zone, landings remained constant until August when port samples indicated high percentages of scallops less than 11g. When port samples indicated an increase in small scallops less than 11 g, SPA 6A was closed to the Mid Bay Fleet end of August. SPA 6A remained open to the Full Bay vessels as the fleet had not caught their quota.

In 1998, there were approximately 207 Mid Bay scallop licenses issued by the DFO Licensing Unit. Numbers of Mid Bay licenses has remained relatively constant though the last several years. The majority of these vessels carry multiple licenses with species dependent seasonal openings and closures. With the development of several new fisheries there has been more diversification and the number of non-scallop licenses has increased in the last few years. There are 99 Full Bay licenses and several vessels also carry licenses to fish other species. In 1998 approximately 117 Mid Bay vessels and 33 Full Bay vessels fished SPA 6. There was little change in the numbers of active Mid Bay vessels from 1997. This was a decrease of 11% for the Full Bay fleet from 1997.

In 1998 the quota for Full Bay fleet was 50 t with a maximum of 30 t from the Grand Manan Island inside zone, SPA 6B. The meat count was reduced to 40/500g and the minimum shell height was 100 mm. Preliminary Full Bay fleet landings for SPA 6 were 37 t, an overall increase of 12% from 1997. The breakdown by subarea was 19 t landed from SPA 6A, a decrease of 10% from 1997 and 18 t from SPA 6B,an increase of 50% from 1997 (Table 2).

The quota for the Mid Bay fleet in 1998 was 80 t with a maximum of 50 t from the Grand Manan Island inside zone. Meat counts were permitted to remain at 45/500g and minimum shell height was 95 mm provided an industry sponsored port sampling program was developed. Preliminary landings for the Mid Bay fleet for SPA 6 were 142 t, a 49% increase from 1997. The breakdown by subarea was 82 t from SPA 6A, an increase of 71% and 60 t from SPA 6B, an increase of 37% from 1997 (Table 2). The quota was

reached during the first quarter while fishing was concentrated in the inside zone. Additional fishing above the quota was permitted in the outside zone with the use of the industry sponsored port sampling program to monitor the presence of smaller meats. There had been minimal fishing in the outside zone during the first quarter of 1998.

Preliminary catch rates for SPA 6 are available from the Full Bay fleet (Table 3). Yearly catch rates from 1990 to 1998 are variable. Catch rates for the inside zone (SPA 6B) ranged from 10.0 to 31.6 kg/h. The outside zone (SPA 6A) catch rates ranged from 6.7 to 18.8 kg/h. Since 1996 catch rates have remained fairly constant. (Figure 4). It must be noted that logbook compliance was very low in the earlier years therefore catch rates prior to 1996 may not be representative of the fishery. In 1998 the catch rate for SPA 6A was 8.6 kg/h, an increase of 28% from 1997. The catch rate for SPA 6B was 11.5 kg/h, an increase of 15% from 1997. Monthly catch rates follow the seasonal trends indicated in the landing statistics (Figure 6). The inside zone catch rates declined after the initial peak in January. Outside zone catch rates decreased through the first quarter. There was minimal change in catch rates from March through to August.

Preliminary catch rates for SPA 6 have been calculated for the Mid Bay fleet (Table 4). Yearly catch rates are highly variable and should be interpreted with caution as noted previously. When accurate locations are not provided it is difficult to partition catch and effort information to the appropriate SPA subarea and calculate catch rates. Catch rates ranged from 4.7 to 11.7 kg/h for SPA 6A or the outside zone. SPA 6B or inside zone catch rates ranged from 7.3 to 10.9 kg/h (Figure 5). Catch rates showed a modest increase from 1996 to 1998 possibly due to greater logbook compliance. The 1998 catch rate for SPA 6A was 6.8 kg/h, an increase of 26 % from 1997. The catch rate for SPA 6B was 8.9 kg/h, an increase of 21 % from 1997. Monthly catch rates for the Mid Bay fleet are not available. Generally Mid Bay fleet catch rates tend to be lower than those from the Full Bay fleet. This could be due to the smaller vessels that comprise the Mid Bay fleet.

Port Sampling

A total of 5,110 meat weights from 128 samples were collected from the Grand Manan Island area in 1998 (Table 5). Mean meat weights were higher in the first quarter samples collected from the inside zone and decreased after March when the zone closed and fishing continued in the outside areas. The monthly 'meat count' per 500g increased gradually through the year. Once the fishing moved outside the inside zone numbers of meats less than 11g increased in the catch for the remainder of the year. The fishery closed in August when and the percentage of small scallops found in the samples increased and the 'meat count' increased above the limit of 45 meats per 500g. Figure 7 indicates the catch composition of the samples collected.

There were 795 meat weights from 20 samples collected off Campobello Island area (Table 6). In the three month period samples were collected, the mean meat weight was between 14 and 15 g. The 'meat count' per 500g ranged from 31 and 35 meats, within the

limit of 45 meats per 500g. Samples were comprised of a high percentage of larger scallops which resulted in few meats under 11g in the catch (Figure 8).

Locations of port samples collected in 1998 are indicated in Figure 9. Total weight sampled was 80 kg representing less than 1 % of the landed catch.

Port samples are not available from the Full Bay Fleet fishing in SPA 6.

Research Survey

Station locations for the 1998 research survey are indicated in Figure 10. As in previous years the higher concentrations were found generally in SPA 6B, inside zone.

The 1998 survey indicated an overall increase of 6% in the mean number of scallops per standard tow from 1997. Although the mean number of commercial sized scallops decreased by 20% from 1997, it was the increase of 88% in prerecruits that raised the mean for 1998. (Table 7). The prerecruits were concentrated between 20 and 40 mm shell height. The 1998 survey indicated the number of commercial sized scallops had decreased from the previous year (Figure 11).

Mean number of scallops per standard tow as calculated for all sizes from the inside zone indicated no change from 1997. There was an increase of 102% in prerecruits from the 1997 numbers but this was still below the numbers found in the 19[illegible]rvey (Figure 12). The 1998 survey indicated a decrease of 37% in commercial sized scallops from 1997 survey, a further decrease from 1996 (Table 7). This decrease was noticeable for shell height range 85-105 mm. The large numbers of 85 to 105 mm scallops found in the 1997 survey have been subjected to concentrated fishing effort in 1998 (Figure 12).

Mean numbers per standard tow have traditionally been lower in the outside zone. The numbers calculated for the outside zone from the 1998 survey indicate an overall increase of 25% from 1997. There was an increase of 30% in prerecruits mainly concentrated in the 20-35 mm range. There was an increase of 24 % in the scallops >80 mm from 1997 (Table 7). Mean numbers between 100 to 115 mm have decreased but those between 80 to 95 mm show an increase (Figure13). This increase can be attributed to one station located in deeper water. The meat yield from these scallops was generally lower for that shell height range than other outside areas. The shell height of these scallops was concentrated between 95 to 115 mm.

Allometric relationships derived from shell height and meat weight regressions were used to calculate mean weight per standard tow. In 1998, 3 scallops per 5 mm shell height were collected and shell heights and meat weights recorded and shells were labeled and saved for ageing. The entire catch was measured and scallop meats weighed in the 1996 and 1997 surveys. The highest catches were found in Duck Island Sound followed by the remainder of the inside zone. A large portion of the outside zone has lower meat yield due in part to the deep water areas where habitat may be marginal for scallops.

Mean weight per standard tow expressed as kilograms of meats was calculated for the survey stations (Table 8). In 1998 the overall mean weight was 0.87 kg/std.tow a decrease of 24% from the 1997 survey. There was a decrease of 27% for scallops > 80 mm and the mean weight for prerecruits (<80 mm) remained the same from the 1997 survey. The inside zone (SPA 6B) had an increase of 8% for prerecruits. Commercial size scallops with a mean weight of 0.95 kg/std. tow, had a decrease of 35% from 1997. The mean weights for the outside area (SPA 6A) indicated a 3% decrease in scallops >80mm with a mean weight of 0.61 kg/std.tow. Scallops < 80mm had a 33% decrease in mean weight. The decrease in the outside area would have been greater but for the contribution of the one station mentioned in the earlier discussion of mean numbers.

Conclusions

While landings from districts 49 to 53 most closely approximate the area of SPA 6 these values correspond closely with the Mid Bay Fleet landings and a small number of Full Bay vessels. The catches from most of the Full Bay vessels and a small number of Mid Bay vessels fishing in SPA 6 are landed in Nova Scotia. Since 1997 landings have been available by SPA. Prior to this comparisons of actual catches of both fleets fishing in SPA 6 are not possible. The New Brunswick inshore inside zone landings are included with the landings from SPA 6A. A large percentage of the landings from SPA 6A in the first quarter could be attributed to this inside zone.

The extremely low logbook compliance until 1996 means that any catch rates calculated prior to 1996 may not adequately represent the fishery. In some cases when there has been logbook compliance there has been very little C1 data which is required to calculate catch rates. Provided DMD regulations remain in place chances are there will be more information on the fishery available in future years. The quality of the data will need monitoring. Locations will need to be verified, catch and effort data on a document should match for CPUE calculations to be accurate.

The Mid Bay license numbers remain constant at approximately 207 and active vessels at 120. As the Full Bay fleet is on an IQ system, there may be increased pressure for those vessels to fish the assigned quota from SPA 6.

The industry sponsored port sampling program in 1998 was successful. The port samples were collected from locations that represented the fishery and showed catch composition for the time period samples were available.

Survey indices of mean number and mean weights of scallops per standard were used to identify trends in the stock. There was an overall increase in mean numbers of prerecruits from 1997. Mean numbers were the lowest for SPA 6B or the inside zone in 1998. The modest increase in mean numbers for the outside zone should be interpreted with caution. The mean weights per tow for commercial sized scallops in each of the zones have decreased and were the lowest for this survey series.

Survey, fishery and port sampling information indicate that SPA 6B continues to be more productive than the outside area, SPA 6A, and should be protected against overfishing.

Summary

- Landings in 1998 for SPA 6 were 179 t. Mid Bay fleet landed 82 t in 6A and 60 t in 6B. The Full Bay landed 19 t in 6A and 18 t in 6B.

- There was an increase in the number of Full Bay licenses fishing SPA 6 in 1998. Numbers of Mid Bay licenses fishing SPA 6 remained constant.

- The increase in commercial catch rates in 1998 was due to the higher biomass in the inside zone indicated in the 1997 survey. This biomass was subject to concentrated fishing effort in 1998.

- The industry sponsored port sampling program for the Mid Bay fleet provided catch composition information. There were no samples from the Full Bay fleet. Catch composition by month indicated fewer small scallops caught in the first quarter when fishing was in the inside zone however when the zone closed and fishing was limited to the outside zone, there was an increase of small meats being landed over time.

- Survey results indicate an increase in mean numbers of prerecruits (<80 mm) in both 6A and 6B, a modest increase in scallops >80 mm in 6A and a decrease in scallops >80 mm in 6B, the inside zone. The survey mean weights (kg/std. tow) for both inside (SPA 6B) and outside (SPA 6A) zones and overall for commercial sized scallops have decreased and are the lowest for this survey series.

- The 1999 recommended catch level had already been set at 150 t (maximum 110 t from both inside zones).

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Table 1 . Historical landings (t of meats) by Statistical Districts 49 to 53 from 1980 to 1998. *1998 is preliminary. Source: Commercial Data Division, Policy and Economics Branch, DFO

	Statistical District					
Year	49	50	51	52	53	Total
1980	0.00	144.7	9.1	9.1	0.2	163.1
1981	1.90	485.3	50.4	11.5	8.6	557.7
1982	2.90	240.1	21.7	22.3	1.8	288.8
1983	14.90	265.9	46.3	4.0	6.3	337.4
1984	12.90	207.0	50.9	2.6	11.9	285.3
1985	5.80	181.6	33.5	4.2	12.4	237.5
1986	23.50	172.9	44.8	0.8	10.9	252.9
1987	36.80	132.3	51.0	2.5	14.2	236.8
1988	20.10	250.8	110.1	3.0	14.0	398.0
1989	47.50	361.8	184.9	2.9	26.5	623.6
1990	53.50	308.8	186.2	1.9	21.3	571.7
1991	39.30	182.9	148.4	2.2	4.3	377.1
1992	38.55	185.5	125.5	4.1	10.2	364.0
1993	96.99	184.7	105.2	5.2	16.6	408.7
1994	86.39	169.3	63.1	6.0	19.5	385.6
1995	66.87	183.7	28.7	6.0	11.1	296.4
1996	37.35	112.3	38.8	4.5	3.4	196.3
1997	15.54	96.0	26.9	8.8	4.9	152.2
1998*	10.48	115.9	33.2	8.1	7.5	175.1

Table 2. Landings and quotas ('effort cap') for SPA 6 from the Full and Mid Bay Fleets. Numbers in the brackets indicate catch from SPA 6B and quota limit from SPA 6B . Source: Commercial Data Division, Policy and Economics Branch, DFO

Year		Full Bay Fleet	Mid Bay Fleet	Total
1997	Catch (t)	33 (12)	95 (35)	128 (47)
	Quota (t)	70 (50)	100 (80)	170 (130)
1998	Catch (t)	37 (18)	142 (60)	179 (78)
	Quota (t)	50 (30)	80 (50)	130 (80)

Table 3 . Commercial catch rates, CPUE (kg/h), from Full Bay fleet Class 1 (C1) data fishing SPA 6. 6A is the outside area and 6B is the inside zone. All values are preliminary.

Year	Area	Catch	Cl Catch	Cl Effort	CPUE (kg/h)	No. Vessels C1
1990	6A	0	0	0	0	0
	6B	0	0	0	0	0
1991	6A	975	0	0	0	0
	6B	0	0	0	0	0
1992	6A	172	172	15	11.47	1
	6B	0	0	0	0	0
1993	6A	710	150	8	18.75	1
	6B	4,275	2,021	89	22.71	6
1994	6A	432	126	10	12.6	1
	6B	1,762	1,422	45	31.6	1
1995	6A	5,305	2,144	219	9.79	5
	6B	78	0	0	0	0
1996	6A	4,538	2,645	207	12.78	7
	6B	10,518	2,204	202	10.91	6
1997	6A	16,876	14,879	2,225	6.69	31
	6B	10,903	10,284	1,028	10	24
1998	6A	13,266	12,527	1,460	8.58	26
	6B	16,526	15,239	1,320	11.54	26

Table 4 . Commercial catch rates, CPUE (kg/h), from Mid Bay fleet Class 1 (C1) data fishing SPA 6. 6A is the outside area and 6B is the inside zone. All values are preliminary.

Year	Area	Catch	Cl Catch	Cl Effort	CPUE (kg/h)	Std. Dev.	No. Vessels C1
1992	6A	0	0	0	0	0	0
	6B	0	0	0	0	0	0
1993	6A	150	85.28	18.0	4.73	0.43	2
	6B	0	0	0.0	0	0	
1994	6A	612	513	56.3	9.12	4.77	2
	6B	563	66	6.5	10.12	1.78	1
1995	6A	3,469	2,239	191.8	11.68	8.4	3
	6B	679	456	41.8	10.92	2.12	2
1996	6A	12,893	9,743	1,350.9	7.21	51.51	24
	6B	2,169	1,517	1,163.7	8.61	8.13	17
1997	6A	65,561	60,098	11,177.3	5.38	4.93	124
	6B	36,419	34,152	4,673.0	7.31	4.61	62
1998	6A	78,984	72,984	12,169.0	6.82	3.54	105
	6B	58,955	56,068	6,318.4	8.87	4.67	51

Table 5. 1998 Grand Manan Island area industry sponsored port sampling program statistics .

Month	N	Meat Weight (g) Mean	SD	Min	Max	Meat Count per 500g	Total Weight (g)	% no. 11g meats	Number samples
January	1117	14.74	5.59	4.30	42.60	33.92	16,467.40	25.07	28
February	1033	15.08	5.94	3.60	38.90	33.16	15,577.20	27.59	32
March	515	15.34	5.90	4.80	35.40	32.60	7,897.70	25.63	16
May	905	10.65	3.11	3.70	24.60	46.93	9,641.60	56.91	18
June	718	11.52	3.34	4.70	26.20	43.41	8,269.80	50.42	16
July	509	12.69	4.72	4.80	38.80	39.39	6,461.50	42.83	12
August	313	10.04	3.11	4.70	24.40	49.79	3,143.30	67.09	6
Total	5110	13.24	5.19	3.60	42.60	37.88	67,458.50	39.18	128

Table 6. 1998 Campobello Island area industry sponsored port sampling program statistics .

Month	N	Meat Weight (g) Mean	SD	Min	Max	Meat Count per 500g	Total Weight (g)	% no. 11g meats	Number samples
May	285	14.18	2.56	10.00	22.50	35.27	4040.6	14.74	6
June	288	15.61	4.44	8.90	47.70	32.02	4496.5	4.86	8
July	222	15.80	7.93	8.50	57.90	31.65	3507	21.17	6
Total	795	15.15	5.24	8.5	57.9	33.00	12044.1	12.96	20

Table 7. Mean number of scallops per standard tow from research surveys. se = standard error. N = number of stations

Year	Inside				Outside				Combined			
	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N
1996	88.6	142.9	231.6	32	19.3	46.0	65.3	33	67.0	80.2	147.2	65
	(9.9)	(27.3)	(34.3)		(7.4)	(6.0)	(10.8)		(8.5)	(21.2)	(27.1)	
1997	35.8	102.9	138.8	35	9.6	46.7	56.3	30	23.7	77.0	100.7	65
	(5.7)	(12.3)	(16.9)		(2.3)	(7.4)	(9.2)		(4.7)	(10.9)	(14.7)	
1998	72.4	64.9	137.3	50	12.5	58.1	70.5	43	44.6	61.8	106.4	93
	(11.5)	(7.0)	(16.8)		(3.1)	(13.1)	(15.7)		(9.5)	(10.2)	(16.8)	

Table 8. Survey mean weight (kg meats) of scallops per standard tow from research surveys. se = standard error. N = number of stations.

Year	Inside				Outside				Combined			
	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N
1996	0.42	1.18	1.6	32	0.03	0.65	0.68	33	0.22	0.91	1.13	65
	(0.10)	(0.13)	(0.18)		(0.01)	(0.08)	(0.09)		(0.07)	(0.10)	(0.15)	
1997	0.12	1.46	1.58	35	0.03	0.63	0.66	30	0.08	1.08	1.15	65
	(0.03)	(0.16)	(0.18)		(0.01)	(0.09)	(0.10)		(0.02)	(0.14)	(0.16)	
1998	0.13	0.95	1.08	50	0.02	0.61	0.63	43	0.08	0.79	0.87	93
	(0.02)	(0.10)	(0.11)		(0.01)	(0.11)	(0.12)		(0.02)	(0.10)	(0.12)	

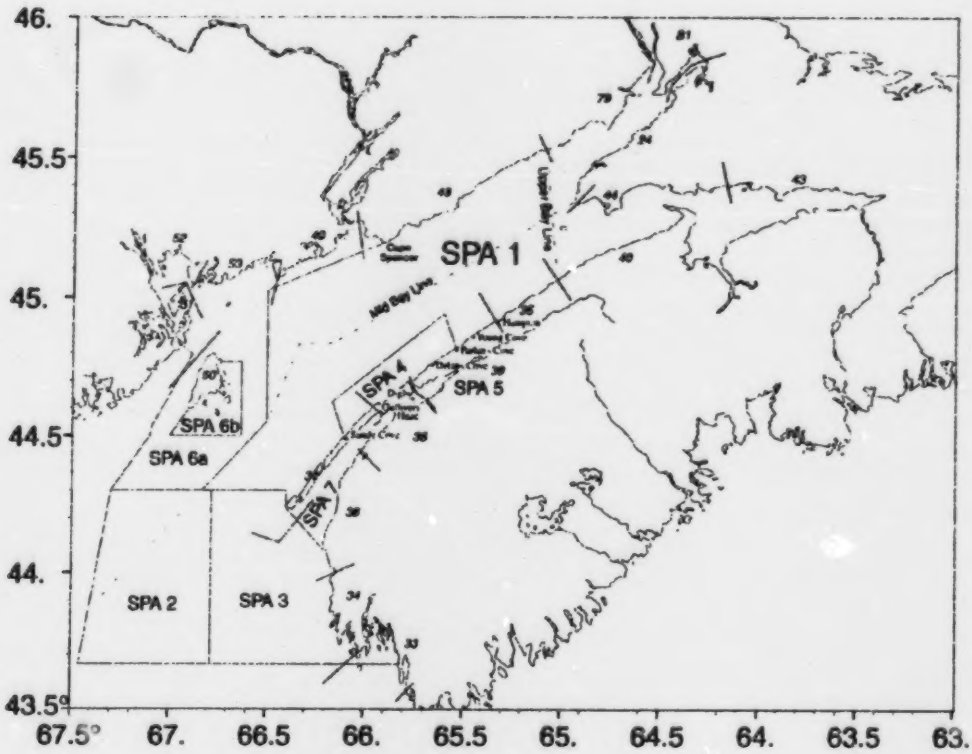

Figure 1. - Scallop Production Areas (SPA's), regulated lines and Statistical Districts in the Bay of Fundy.

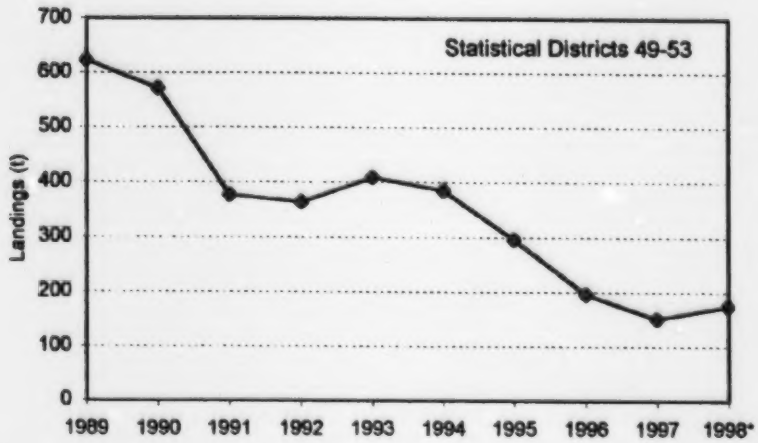

Figure 2 . Yearly landings compiled by Statistical Districts 49 to 53. *1998 is preliminary.

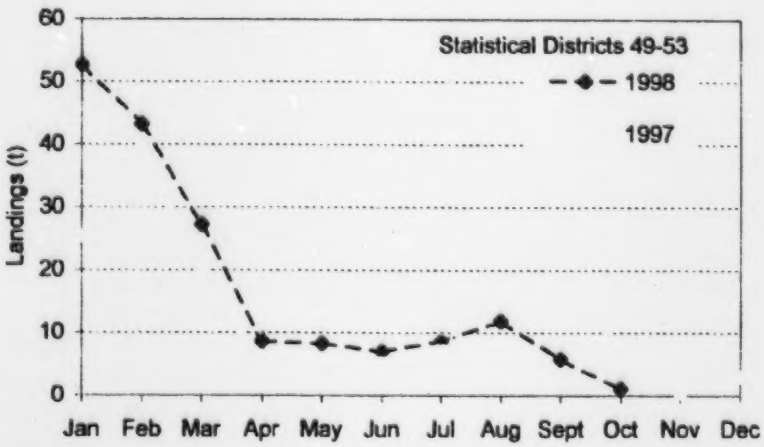

Figure 3 . Landings from Statistical Districts 49 to 53 by month for 1997 and 1998. 1998 is preliminary.

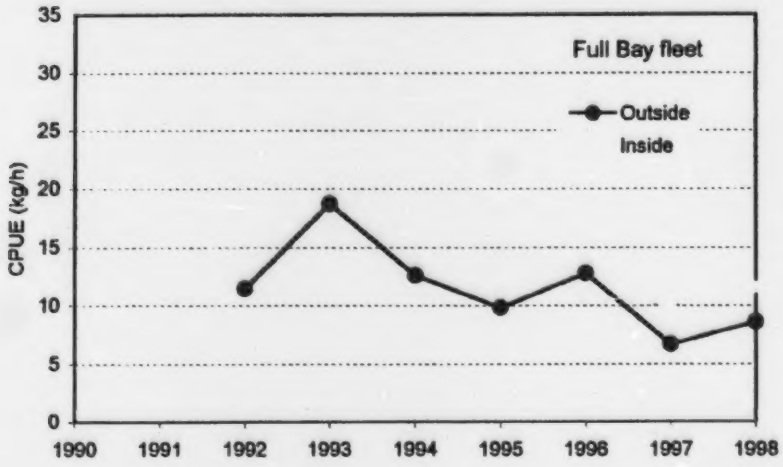

Figure 4 . Catch rates (kg/h) for the inside and outside zones from the Full Bay Fleet.

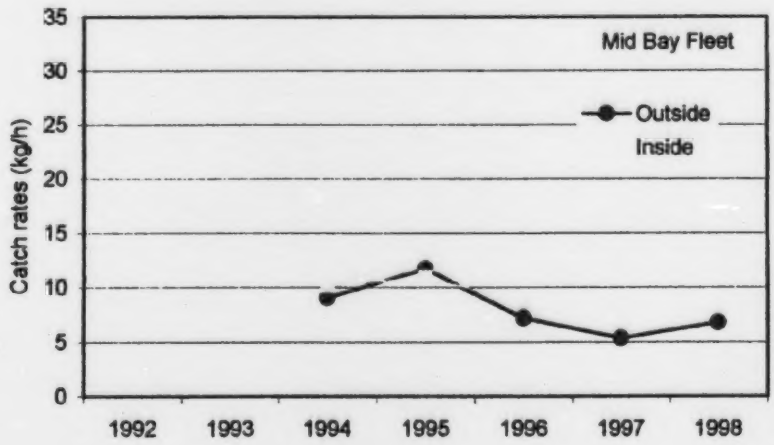

Figure 5 . Catch rates (kg/h) for the inside and outside zones from the Mid Bay Fleet.

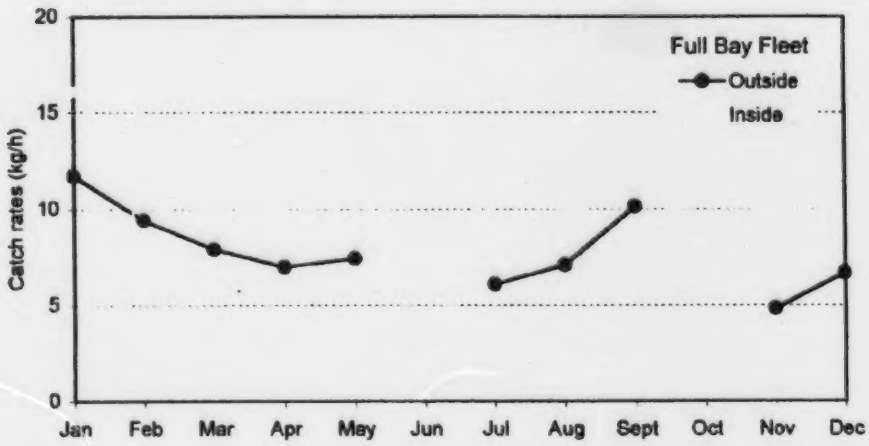

Figure 6 . Monthly catch rates (kg/h) for the inside and outside zones from the Full Bay Fleet.

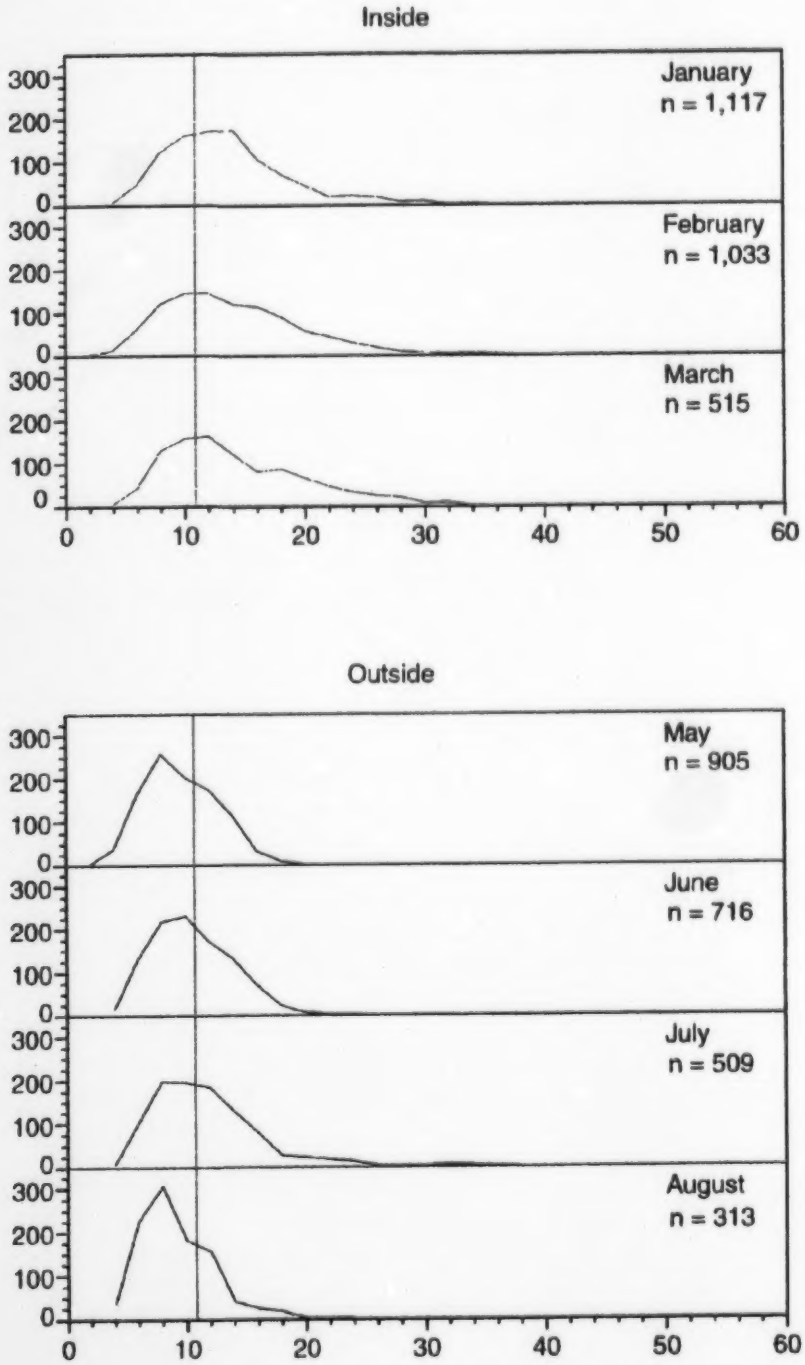

Figure 7. Frequency distribution of meat weights from port samples collected in the Grand Manan Island area. A line marks the 11g meat weight.

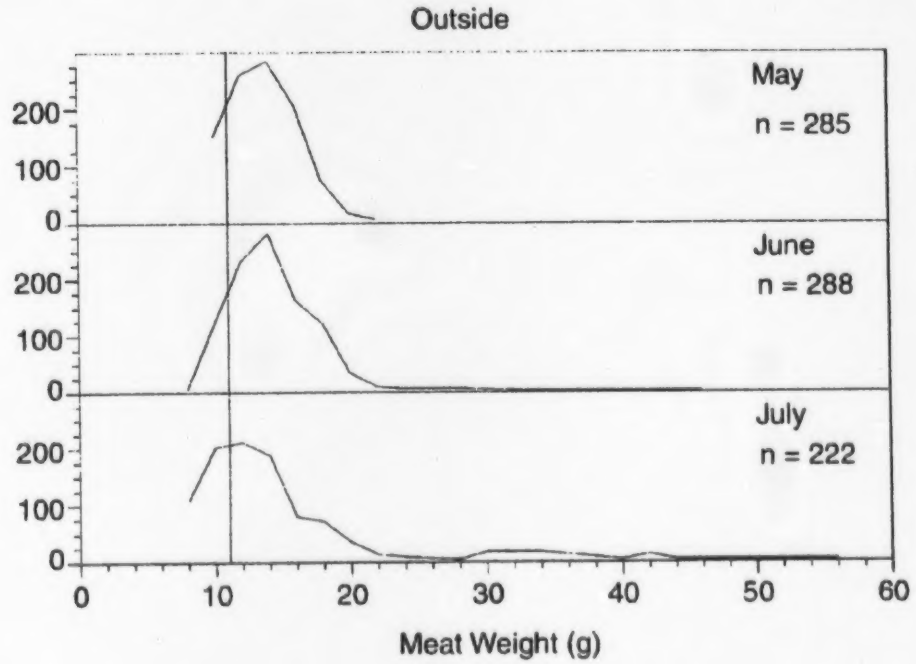

Figure 8. Frequency distribution of meat weights from port samples collected in the Campobello Island area. A line marks the 11g meat weight.

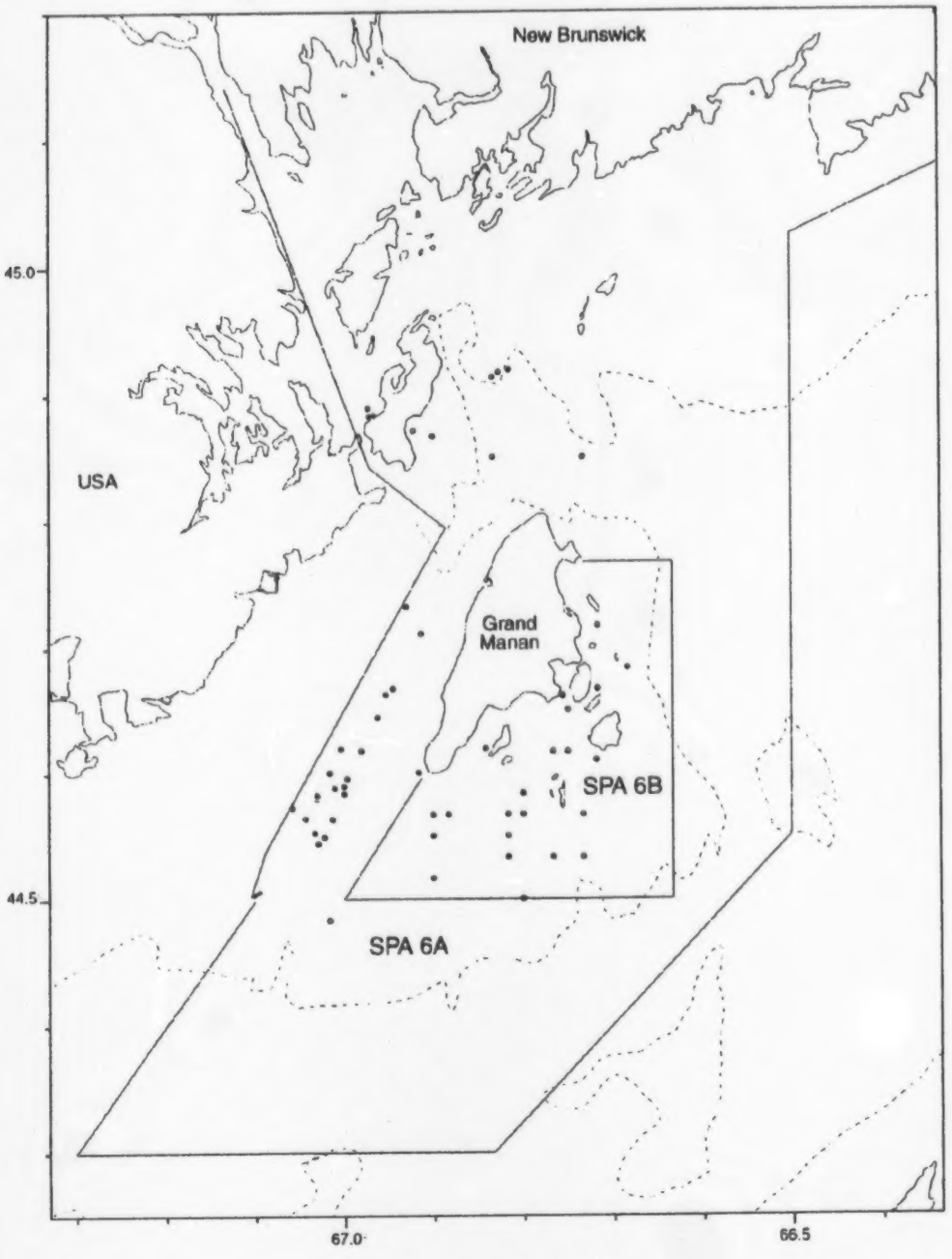

Figure 9. Fishing locations from the 1998 commercial port samples.

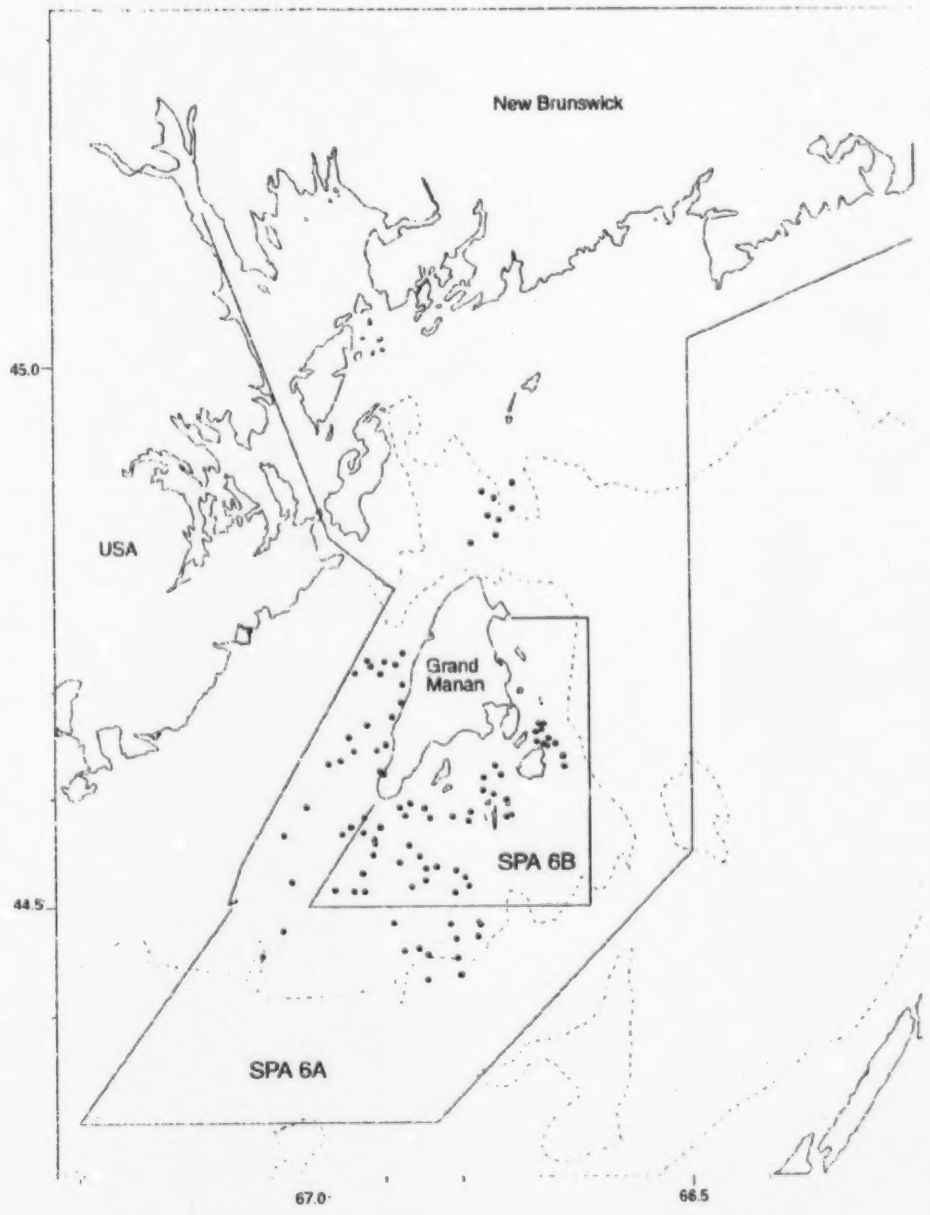

Figure 10. 1998 Grand Manan area, SPA 6, scallop assessment survey stations.

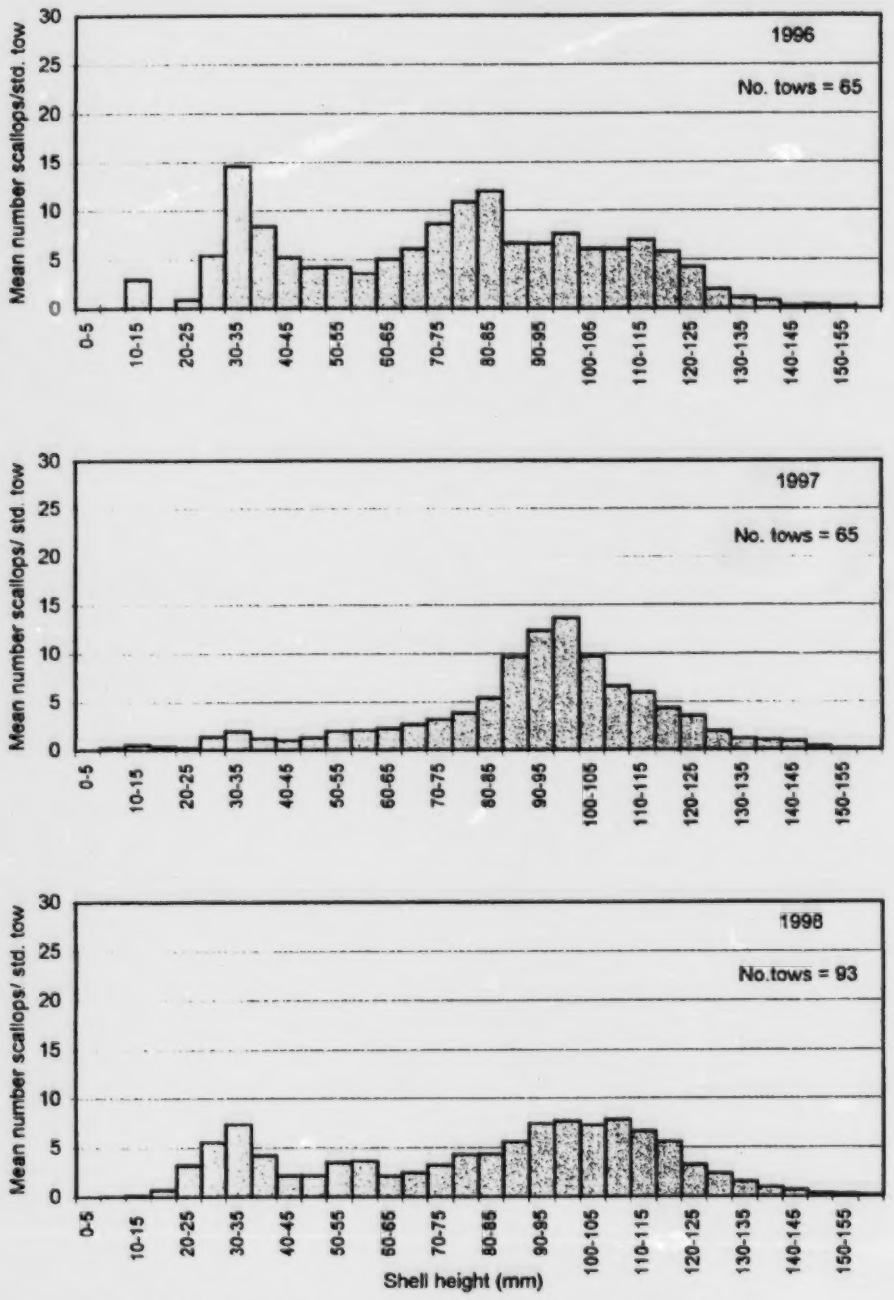

Figure 11. Shell height distribution from annual stock surveys, all areas combined.

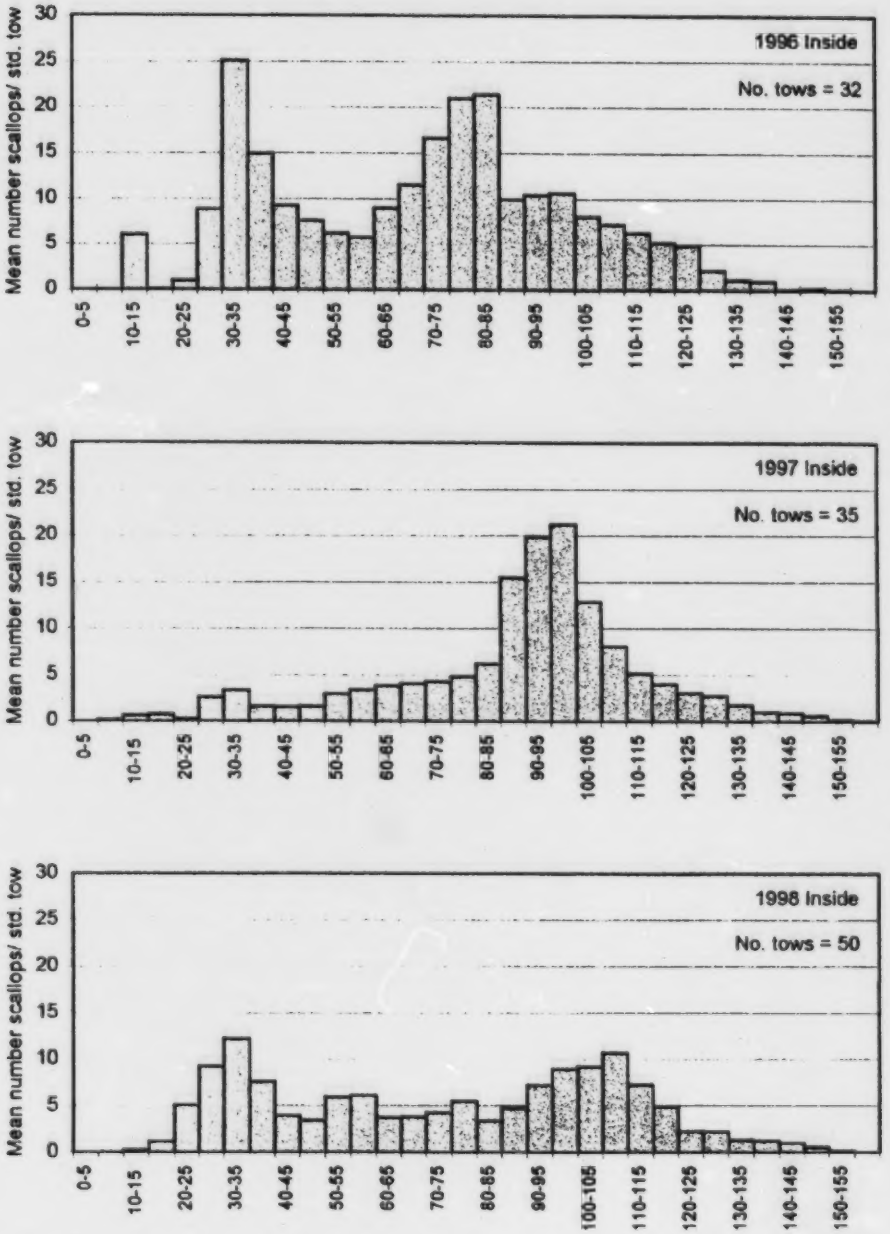

Figure 12. Shell height distribution from annual stock surveys inside the Grand Manan Island inside zone.

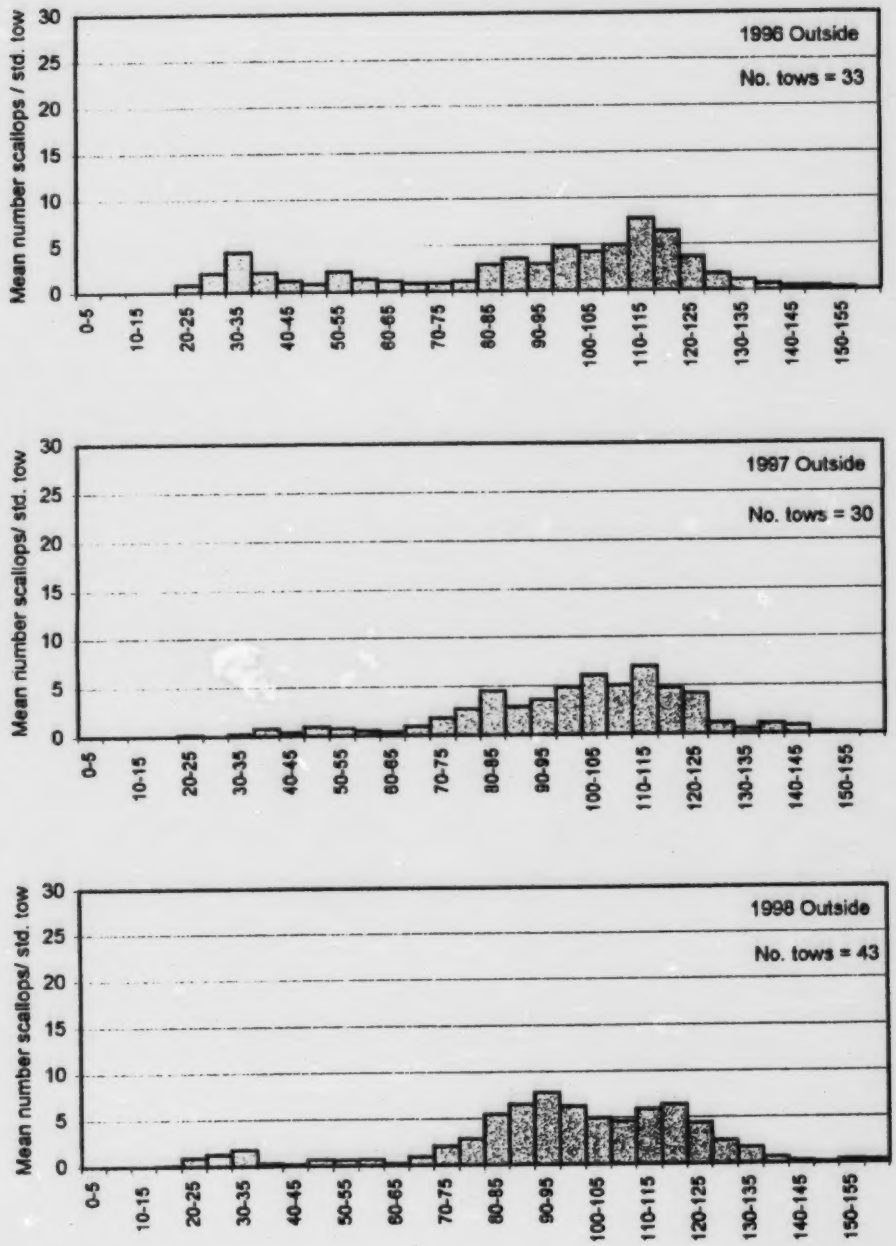

Figure 13. Shell height distribution from annual stock surveys outside the Grand Manan Island conservation zone.